Continuous water-quality monitoring at Mattamuskeet NWR: A foundation for national wildlife refuge water-quality partnerships

FY 2015

PROJECT DESCRIPTION

The U.S. Fish and Wildlife Service partnered with the U.S. Geological Survey to operate two automated water-quality monitoring stations at Lake Mattamuskeet. Stations measure parameters (Table 1) important to understanding lake health. The data help inform management and assist cooperative assessments of the lake and its living resources.

Now entering its fourth year (see FY12, FY13 and FY14 project updates), the project's success includes additional partners, use of data in management and research planning, and expansion of the list of monitored parameters.

Table 1. Lake Mattamuskeet water quality parameters being monitored through this I&M project (**in bold**) and 13 more parameters added via partnerships made possible by the project.

Physical Data	Chemical Data	Biological Data
Dissolved oxygen	*Total phosphorous*	*Chlorophyll a*
Water temperature	*Total nitrogen*	*Phytoplankton*
pH	*Ammonia*	*Algal toxins*
Conductivity	*Kjeldahl nitrogen*	
Salinity	*Total organic N*	
Water level	*Nitrate + nitrite*	
Wind direction	*Total inorganic N*	
Turbidity		
Light attenuation		
Secchi depth		
Total solids		
Suspended solids		

OBJECTIVES AND ALTERNATIVES

Lake Mattamuskeet comprises 41,084 acres of the 50,180 acre Mattamuskeet NWR, so a primary project objective of the refuge is long-term monitoring of key limnological variables to inform lake management decisions. Other objectives include integration of national and regional inventory and monitoring goals, leveraging within-USFWS and external partnerships, building on proven approaches for limnological assessments, generating high quality data, and facilitating resolution of water quality concerns.

METHODS AND PROTOCOLS

Station operation follows established protocols (Wagner et al. 2006. Guidelines and standard procedures for continuous water-quality monitors - Station operation, record computation, and data reporting: U.S. Geological Survey Techniques and Methods 1–D3.). The monitors consist of 1) a metal housing with a data collection platform, 2) satellite transmitter, 3) cables with waterproof connectors, 4) water quality sensors, 5) batteries, 6) solar panels, and 7) staff gage. Field meters are used to standardize and adjust the station probes and document their precision and accuracy.

REAL-TIME HYDROLOGIC DATA

Lake conditions are available near real-time via the USGS's National Water Information System website. The stations make measurements every 15-minutes, and data are transmitted to the GOES satellite and uploaded to the website every hour. Data can be viewed by the public, refuge management, and cooperators at these sites:

Mattamuskeet West
http://waterdata.usgs.gov/nc/nwis/dv?referred_module=sw&site_no=0208458892

Mattamuskeet East
http://waterdata.usgs.gov/nc/nwis/dv?referred_module=sw&site_no=0208458893

The project's profile was improved this year with a website hosted by USGS that will be updated this spring to include results from Phytoplankton and cyanotoxin analysis conducted in 2015:
http://nc.water.usgs.gov/projects/mattamuskeet/index.html

Bell Island Pier
Starting in January of 2016, FWS has partnered with N.C. State University to monitor conditions in the Pamlico Sound at Bell Island Pier in real-time:
http://go.ncsu.edu/bellisland

ACCOMPLISHMENTS AND MANGEMENT IMPLICATIONS

Results of the first year monitoring (September 2012 through September 2013) are available in the 2013 Water-Data Report:

http://wdr.water.usgs.gov/wy2013/pdfs/02084588 92.2013.pdf

http://wdr.water.usgs.gov/wy2013/pdfs/02084588 93.2013.pdf

Second year results (September 2013 through September 2014) are in review and compilation for presentation through similar on-line "Water-Year Summary" pages for each station.

The NC Wildlife Resources Commission (NC WRC) is a key partner at Lake Mattamuskeet. NC WRC funds operations each year and supported installation of staff plates at four lake outfall canals which were surveyed to NAVD88 datum elevations by global navigation satellite system. This optimizes utility of the water level measurements made at the continuous monitoring stations in the main lake -- a significant project enhancement.

The important partnership with the Ambient Lakes Monitoring Program of the NC Division of Water Resources (NC DWR) (described in detail in the FY13 and FY14 project updates) continued in FY15. At no additional costs to the USFWS, grab samples are collected by USGS and analyzed by the NC DWR Water Sciences Chemistry Laboratory. The NC DWR benefits through obtaining data they can use in their Ambient Lakes Monitoring Program and the NC Trophic State Index. The USFWS benefits by getting data on additional water quality parameters to improve understanding of lake health. All data from this partnership are housed in the NC Lakes Database maintained by NC DWR and available to the public via STORET.

In FY15, the USFWS worked with USGS through an NRPC grant to analyze monthly samples in the summer and fall for cyanotoxins and phytoplankton. Previous pilot studies suggested high levels of cyanobacteria and the cyanotoxin, cylindrospermopsin in the lake. Results are forthcoming.

Two data summaries were delivered to managers and stakeholders in 2015:

Moorman M, Augspurger T. 2015. Utilizing continuous monitoring and discreet data to understand water-quality at Lake Mattamuskeet National Wildlife Refuge. Fifth Interagency Conference on Research in the Watersheds (ICRW5), March 4, Charleston, SC.

Augspurger T. 2015. Lake Mattamuskeet Overview and Initial Water Quality Retrospective. Mattamuskeet Collaboration Team Meeting, February 11, Raleigh, NC.

Long-term monitoring of lake water quality and quantity is critically important to informing lake management decisions, and the data from this project are already being utilized. The utility of the project was emphasized by inclusion of the monitoring stations for long-term funding among the action items (1.g) for the newly formed Mattamuskeet Collaboration Team.

PARTNERS

USFWS – Refuges, Ecological Services, Fisheries, Migratory Birds

USGS – North Carolina Water Science Center

NC WRC – Inland Fisheries

NC DWR – Water Sciences Section

NCSU – North Carolina State University

SOURCES OF SUPPORT

USFWS Inventory and Monitoring funds have been matched over 100%. Initial funding came from the USFWS Natural Resource Program Center through a Water Quality Pilot Project. Funds were matched by Mattamuskeet NWR, Southeast Regional Office, South Atlantic Migratory Bird Coordination Office, South Atlantic Fish and Wildlife Conservation Office, and Raleigh Ecological Services. FY13 - FY15 funds were from USFWS I&M Program and Mattamuskeet NWR. Those offices and NCWRC have funded operations through September 2016.

MORE INFORMATION

Michelle Moorman, Mattamuskeet NWR Biologist, 252-926-4021, michelle_moorman@fws.gov